

CLAIMS:

1. Apparatus for providing a fluid meniscus with variable configurations by means of electrowetting, the apparatus comprising:

a fluid chamber (5; 105);

two different fluids (A; B) separated by a meniscus (14; 80; 88; 94; 98; 514) of

5 which an edge, having different sides, is constrained by the fluid chamber;

a first electrowetting electrode (2a; 41; 141; 241; 341; 441; 502a) and a second electrowetting electrode (2a'; 43; 143; 243; 343; 443; 502a'), the first electrowetting electrode being arranged to act on a first side of the meniscus edge and the second electrowetting electrode arranged to act separately on a second side of the meniscus edge;

10 and

a voltage control system for providing a different voltage to said first and second electrowetting electrodes respectively to form a selected meniscus configuration.

2. Apparatus according to claim 1, wherein said fluid chamber includes a fluid

15 contact sidewall arrangement (10; 46; 58; 110; 210; 310; 410; 510) defining a perimeter of the fluid chamber said first and second electrowetting electrodes being mutually spaced about said perimeter.

3. Apparatus according to claim 2, comprising one or more pairs of oppositely

20 lying electrowetting electrodes (2a'; 41, 43) arranged about said perimeter.

4. Apparatus according to claim 3, comprising two pairs (41, 43; 42, 44) of oppositely lying electrowetting electrodes, the pairs being arranged substantially perpendicular to each other about said perimeter.

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5. Apparatus according to any of claims 2 to 4, wherein the electrowetting electrodes (2, 52, 502) are arranged substantially circularly about said perimeter.

6. Apparatus according to claims 2 to 5, wherein the width of each electrowetting electrode (52) is smaller than the distance between two adjacent electrowetting electrodes, each being measured in angular distance about the fluid contact sidewall.
- 5 7. Apparatus according to any of claims 2 to 5, wherein the width of each electrowetting electrode (2; 41; 43; 141; 143; 241; 243; 341; 343; 441; 443; 502) is larger than the distance between two adjacent electrowetting electrodes, each being measured in angular distance about the fluid contact sidewall.
- 10 8. Apparatus according to any preceding claim, wherein adjacent electrowetting electrodes are connected by an electrically resistive material (56) capable of providing a gradually varying voltage change across the adjacent electrodes.
- 15 9. Apparatus according to any preceding claim, wherein said voltage control system is adapted to be capable of rotating a pattern of voltages about the electrowetting electrodes.
10. Apparatus according to any preceding claim, comprising a mechanical system for physically rotating the electrowetting electrodes about a rotation axis.
- 20 11. Apparatus according to any preceding claim, further comprising a radiation source (3; 103; 203; 303; 403; 503) for emitting a radiation beam along an optical axis (1; 101; 201; 301; 401; 501).
- 25 12. Apparatus according to any preceding claim, wherein said voltage control system is adapted to be capable of applying voltages across the electrowetting electrodes so as to provide varying amounts of deflection of an incoming radiation beam by the fluid meniscus, the deflection involving a change of alignment of the optical axis of the radiation beam.
- 30 13. Apparatus according to claim 12, wherein the apparatus is configured such that the deflection by the fluid meniscus is of a refractive nature.

14. Apparatus according to claim 12, wherein the apparatus is configured such that the deflection by the fluid meniscus is of a reflective nature.

5 15. Apparatus according to any preceding claim, wherein the apparatus is adapted to provide a fluid meniscus configuration in which a first contact angle of the fluid meniscus at the first side is less than 90° ($\theta_5; \theta_{10}; \theta_{11}$) and a second contact angle ($\theta_4; \theta_8; \theta_9$) of the fluid meniscus at the second side is greater than 90°.

10 16. Apparatus according to any preceding claim, wherein the apparatus is adapted to provide a fluid meniscus configuration in which both a first fluid contact angle (θ_{16}) of the fluid meniscus at the first side and a second contact angle (θ_{17}) of the fluid meniscus at the second side of the fluid contact sidewall are less than 90°.

15 17. Apparatus according to any preceding claim, wherein apparatus is adapted to provide an anamorphic fluid meniscus configuration.

18. Apparatus according to any preceding claim, wherein the different fluids (A; B; B') within the fluid chamber are of substantially the same density.

20 19. Apparatus according to any preceding claim, comprising two or more independently controllable fluid menisci (86; 88).

25 20. Apparatus comprising an image sensor for the recording of an image scene (20), a variable fluid meniscus (514) and a controller adapted to alter the shape of the meniscus to provide at least:

a first configuration of the variable fluid meniscus, said first configuration directing a first region (22) of the image scene to be recorded towards said sensor; and

30 a second configuration of the variable fluid meniscus, said second configuration directing a second, different, region (24; 26; 28) of the image scene to be recorded towards said sensor.

21. Apparatus according to claim 20, wherein the apparatus further includes an image processor for construction of a single image of said image scene using at least the first and second image scene regions.

22. Apparatus according to claim 20 or 21, wherein the apparatus is adapted to provide variable fluid meniscus configurations for differently deflecting an incoming beam of light.

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23. Apparatus according to any of claims 20 to 22, wherein the apparatus further includes a motion detector for detecting motion of the apparatus, the controller being adapted for controlling the configuration of the variable fluid meniscus (514) in response to the detected motion of the apparatus.

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24. Medical imaging apparatus including a capsule for use *in vivo*, said capsule comprising an image sensor (34) for the recording of an *in vivo* image scene and a variable fluid meniscus arrangement (32).

15 25. Medical imaging apparatus according to claim 24, wherein the variable fluid meniscus arrangement is a lens.

26. Medical imaging apparatus according to claim 24 or 25, comprising a controller adapted to alter the shape of the variable fluid meniscus of the arrangement to 20 provide at least:

a first configuration of the variable fluid meniscus for imaging a first *in vivo* image scene onto said image sensor; and

a second configuration of the variable fluid meniscus for imaging a different, second *in vivo* image scene on said image sensor.